

---

## Space Weather Forecast

Issued on Tuesday, 21 December 2021 at 13:24 Local

This forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

---

**Space Weather Forecast Headline: Slight chance of Minor Geomagnetic Storms day 2 (21st), and on days 3 and 4 (23rd and 24th). Occasional Moderate class flares likely throughout.**

### Analysis of Space Weather Activity over past 24 hours

**Solar Activity:** Solar Activity has been Moderate over the past 24 hours, with a number of common class X-ray flares observed and two Moderate class flares at 21/0750 UTC and 21/1144 UTC. A previous moderate class flare at 20/1136UTC, from an active region in the southern hemisphere of the Sun, produced a weak coronal mass ejection (CME). Analysis of this CME indicates an arrival time on day 3 (23 Dec).

There are currently nine sunspot regions on the Earth facing disc. The most complex of these are a series of three regions in the southern central disc, however, the most recent moderate class flares have been from a region beyond the eastern limb of the Sun. These flares may have generated CMEs, but given their location are unlikely to have any Earth-directed component. All other regions visible are small and simple with limited flare risk, but with the potential for further development. No other CMEs were observed in available imagery.

**Solar Wind / Geomagnetic Activity:** Solar winds have been elevated throughout as a result of a high speed stream from a coronal hole. The Interplanetary Magnetic Field Strength (IMF), B<sub>t</sub> has been moderate to weak throughout. The all important north-south component has also remained moderate to weak. These parameters are likely the result of Earth connecting to coronal hole 36 and lead to Quiet to Active (Kp 1-4) geomagnetic activity.

**Energetic Particles / Solar Radiation:** The count rate of energetic particles (high energy protons) remained at background with no solar radiation storms occurring.

### Four-Day Space Weather Forecast Summary

**Solar Activity:** Solar activity is expected to be predominantly Moderate, with further common class and occasional moderate class flares likely - mainly from AR2907, AR2908 and AR2909, and also the new region beyond the eastern limb.

**Solar Wind / Geomagnetic Activity:** A coronal mass ejection (CME) was seen leaving the sun on the 20th as a result of the Moderate-class flare from the complex sunspot region in the southern centre disc. This has been analysed and is forecast to arrive at Earth during day 3 (23rd Dec). No other CMEs were observed in available imagery. Elevated solar winds are expected to persist through days 1-2 (21st and 22nd) due to coronal hole enhancements, before gradually easing on Day 3 (23rd). Geomagnetic activity is forecast to be Quiet to Unsettled through days 1-2 (21st and 22nd), with Active intervals possible. These are most likely to occur early on day 1 (21st), when there is a chance of a Minor Geomagnetic Storm. On days 3 (23rd and 24th), geomagnetic activity is likely to become mostly Quiet, however the arrival of the weak

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: [moswoc@metoffice.gov.uk](mailto:moswoc@metoffice.gov.uk)

CME gives rise to chance of active intervals, and a small chance of a G1 / Minor Storm on Day 3 (23 Dec).

**Energetic Particles / Solar Radiation:** The count rate of energetic particles (high energy protons) is forecast to stay at background with no solar radiation storms expected. Any significant flares could lead to this count rate increasing, but are still expected to stay below radiation storm level.

## Geomagnetic Storms:

| Geo-Magnetic Storm       | Level    | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) | Day 2 (00-24 UTC) | Day 3 (00-24 UTC) | Day 4 (00-24 UTC) |
|--------------------------|----------|------------------------|-------------------|-------------------|-------------------|-------------------|
| Probability (Exceedance) |          |                        | (%)               | (%)               | (%)               | (%)               |
| Minor or Moderate        | G1 to G2 | No                     | 20                | 10                | 20                | 20                |
| Strong                   | G3       | No                     | 1                 | 1                 | 1                 | 1                 |
| Severe                   | G4       | No                     | 1                 | 1                 | 1                 | 1                 |
| Extreme                  | G5       | No                     | 1                 | 1                 | 1                 | 1                 |

## Radio Blackouts - X Ray Flares:

| X Ray Flares | Level         | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) | Day 2 (00-24 UTC) | Day 3 (00-24 UTC) | Day 4 (00-24 UTC) |
|--------------|---------------|------------------------|-------------------|-------------------|-------------------|-------------------|
| Probability  |               |                        | (%)               | (%)               | (%)               | (%)               |
| Active       | R1-R2 M Class | Yes                    | 60                | 60                | 60                | 60                |
| Very Active  | R3 to R5 X    | No                     | 2                 | 2                 | 2                 | 2                 |

## Solar Radiation Storms - (High Energy Protons):

| Radiation Storms         | Level (cm <sup>-2</sup> sr <sup>-1</sup> s <sup>-1</sup> ) | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) | Day 2 (00-24 UTC) | Day 3 (00-24 UTC) | Day 4 (00-24 UTC) |
|--------------------------|------------------------------------------------------------|------------------------|-------------------|-------------------|-------------------|-------------------|
| Probability (Exceedance) |                                                            |                        | (%)               | (%)               | (%)               | (%)               |
| Active                   | ≥ S1                                                       | No                     | 5                 | 5                 | 5                 | 5                 |
| Very Active              | ≥ S3 *                                                     | No                     | 1                 | 1                 | 1                 | 1                 |

\* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = cm<sup>-2</sup>sr<sup>-1</sup>s<sup>-1</sup>)